

CLAIMS

What is claimed is:

1. An organic electronic device comprising a first electrode, a second electrode, and an organic active layer, wherein:

5 the first electrode lies on an opposite side of the organic active layer compared to the second electrode; and

at least one layer selected from the first electrode, the second electrode, a hole-transport layer, an electron-transport layer, and the organic active layer is configured to achieve low $L_{\text{background}}$.

10 2. A process for forming an organic electronic device comprising the step of forming at least one layer selected from a first electrode, a second electrode, a hole-transport layer, an electron-transport layer, and an organic active layer, wherein:

15 the first electrode lies on an opposite side of the organic active layer compared to the second electrode; and

the at least one layer is designed to achieve low $L_{\text{background}}$.

3. The organic electronic device of claim 1 or the process of claim 2, wherein the at least one layer has a thickness in a range of d_1 - d_2 , wherein d_1 and d_2 are determined by:

20 $2\eta d_1 \cos(\theta) + \phi = (m+1/4)/\lambda$ (Equation 1)

$2\eta d_2 \cos(\theta) + \phi = (m+3/4)/\lambda$ (Equation 2)

wherein:

η is a refractive index of a material of the at least one layer at a specific wavelength (λ);

25 d_1 is a first thickness of the at least one layer;

d_2 is a second thickness of the at least one layer;

θ is an angle of incident radiation;

ϕ is a total phase change of radiation reflected by an ideal reflector at λ ;

30 m is an integer; and

λ is the specific wavelength.

4. The organic electronic device of claim 1 or the process of claim 2, wherein an interfacial reflectivity is no greater than about 30 percent, wherein the interfacial reflectivity is determined by:

35
$$R = \frac{I_{\text{reflected}}}{I_{\text{incident}}} = \left(\frac{\eta_x - \eta_y}{\eta_x + \eta_y} \right)^2$$
 (Equation 3)

wherein:

η_x is a refractive index of the at least one layer; and

η_y is a refractive index of a different layer lying immediately adjacent to the at least one layer.

5. An organic electronic device comprising:
an organic active layer; and
5 a first electrode having a side opposite the organic active layer,
wherein:
the first electrode comprises a first electrode layer lying at the side opposite the organic active layer; and
the first electrode layer is configured to achieve low $L_{\text{background}}$.
- 10 6. The organic electronic device of claim 5, further comprising a second electrode, wherein:
the organic active layer lies between the first electrode and the second electrode;
a second electrode has a side opposite the organic active layer;
15 and
the second electrode comprises a second electrode layer lying at the side opposite the organic active layer; and
wherein the second electrode layer is configured to achieve low $L_{\text{background}}$.
- 20 7. A process for forming an organic electronic device comprising the steps of:
forming an organic active layer; and
forming a first electrode having a side opposite the organic active layer, wherein:
25 the first electrode comprises a first electrode layer lying at the side opposite the organic active layer; and
the first electrode layer is configured to achieve low $L_{\text{background}}$.
- 30 8. The process of claim 7, further comprising a step of forming a second electrode, wherein:
the organic active layer lies between the first electrode and the second electrode;
a second electrode has a side opposite the organic active layer;
and
35 the second electrode comprises a second electrode layer lying at the side opposite the organic active layer; and
wherein the second electrode layer is configured to achieve low $L_{\text{background}}$.

9. The organic electronic device of claim 5 or the process of claim 7, wherein the first electrode layer has a thickness in a range of d_1 - d_2 , wherein d_1 and d_2 are determined by:

$$2\eta d_1 \cos(\theta) + \phi = (m+1/4)/\lambda \quad (\text{Equation 1})$$

5 $2\eta d_2 \cos(\theta) + \phi = (m+3/4)/\lambda \quad (\text{Equation 2})$

wherein:

η is a refractive index of a material of the first electrode layer at a specific wavelength (λ);

d_1 is a first thickness of the first electrode layer;

10 d_2 is a second thickness of the first electrode layer;

θ is an angle of incident radiation;

ϕ is a total phase change of radiation reflected by an ideal reflector at λ ;

m is an integer; and

15 λ is the specific wavelength.

10. The organic electronic device of claim 5 or the process of claim 7, wherein an interfacial reflectivity is no greater than about 30 percent, wherein the interfacial reflectivity is determined by:

$$R = \frac{I_{\text{reflected}}}{I_{\text{incident}}} = \left(\frac{\eta_x - \eta_y}{\eta_x + \eta_y} \right)^2 \quad (\text{Equation 3})$$

20 wherein:

η_x is a refractive index of the first electrode layer; and

η_y is a refractive index of a material lying immediately adjacent to the first electrode layer.

25 11. The organic electronic device of claim 5 or the process of claim 7, wherein the first electrode layer comprises a metal selected from a transition metal and an elemental metal.

12. The organic electronic device or process of claim 11, wherein the metal is selected from a group consisting of Au, Cr, Si, and Ta.

30 13. The organic electronic device or process of claim 11, wherein the first electrode layer further comprises an oxide of the metal.

14. A process for designing an organic electronic device comprising the steps of:

determining a specific wavelength for reflected ambient radiation;

determining η at the specific wavelength for a first material; and

35 determining a range of thicknesses of a first layer of the first material, wherein the range of thicknesses is d_1 - d_2 , wherein d_1 and d_2 are determined by:

$$2\eta d_1 \cos(\theta) + \phi = (m+1/4)/\lambda \quad (\text{Equation 1})$$

$$2\eta d_2 \cos(\theta) + \phi = (m+3/4)/\lambda \quad (\text{Equation 2})$$

wherein:

- 5 η is a refractive index of the first material of the first layer at the specific wavelength (λ);
- d_1 is a first thickness of the first layer;
- d_2 is a second thickness of the first layer;
- θ is an angle of incident radiation;
- ϕ is a total phase change of radiation reflected by an ideal reflector
- 10 at λ ;
- m is an integer; and
- λ is the specific wavelength.

15 15. The process of claim 14, wherein the first layer is selected from a group consisting of an organic active layer, a hole-transport layer, and an electron-transport layer.

16. The process of claim 14, wherein:
the first layer is one of a plurality of layers of an electrode;
the electrode is designed to have a side that is opposite the organic active layer: and
20 the first layer is designed to lie at the side of the electrode opposite an organic active layer.

17. The process of claim 14, wherein the process further comprises:
determining η_x at a specific wavelength for a second material of a
25 second layer; and
determining η_y at the specific wavelength for a third material of a third layer immediately adjacent to the second layer, wherein an interfacial reflectivity at the second and third layers is no greater than about 30 percent, wherein the interfacial reflectivity is determined by:

$$30 \quad R = \frac{I_{reflected}}{I_{incident}} = \left(\frac{\eta_x - \eta_y}{\eta_x + \eta_y} \right)^2 \quad (\text{Equation 3})$$

18. A process for designing an organic electronic device comprising the steps of:
determining η_x at a specific wavelength for a first material of a first layer; and
35 determining η_y at the specific wavelength for a second material of a second layer immediately adjacent to the first layer, wherein an interfacial

reflectivity at the first and second layers is no greater than about 30 percent, wherein the interfacial reflectivity is determined by:

$$R = \frac{I_{reflected}}{I_{incident}} = \left(\frac{\eta_x - \eta_y}{\eta_x + \eta_y} \right)^2 \quad (\text{Equation 3})$$

19. The organic electronic device of claim 1 or 5 or the process of claim 2, 7, 14, or 18, wherein the organic electronic device is selected from the group of light-emitting displays, radiation sensitive devices, photoconductive cells, photoresistors, photoswitches, photodetectors, phototransistors, and phototubes.

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